REMARKS

The concurrently filed RCE Transmittal is noted. It is respectfully submitted that the present amendments, as well as the present Remarks, including reliance on evidence in Applicants' specification, constitute the necessary Submission for the RCE Transmittal; and, moreover, in view of filing of the RCE Transmittal, it is respectfully submitted that entry of the present amendments is proper as a matter of right, notwithstanding the Finality of the Office Action mailed November 25, 2008.

By the present amendments, Applicants are adding claim 22 to the application, as an independent claim in the application. Claim 22 defines a method for manufacturing a separator for a fuel cell, having a rib portion, a flat portion and opening portions within the flat portion. Claim 22 recites that the method includes steps of pulverizing expanded graphite sheets and mixing the resulting expanded graphite powder with a resin to yield a mixed powder; subjecting the mixed powder to compression molding to yield a sheet for molding; and placing the sheet for molding on a mold plate, superposing at least one additional sheet for molding fitted in shape to the flat portion, and subjecting them to compression molding. Note, for example, pages 30-32 of Applicants' specification. Claims 1-7 and 16-21, including previous independent claims 1, 4 and 6, previously directed to a separator, have been amended to be dependent ultimately on claim 22, reciting a method. Claim 14 has been amended to recite a fuel cell comprising a separator for fuel cell formed by the method according to any one of claims 4 and 6.

In addition to claim 22, Applicants are adding new claim 23 to the application. New claim 23 recites a fuel cell including the separator according to claim 8. Note previously considered claim 14.

The undersigned notes the concurrently filed Information Disclosure Statement. It is respectfully submitted that all documents being submitted with this Information Disclosure Statement satisfy the timing requirements of 37 CFR 1.97, being filed concurrently with the aforementioned RCE Transmittal; and it is respectfully submitted that such documents submitted with this Information Disclosure Statement are to be considered by the Examiner during further examination of the above-identified application.

The undersigned notes new claim 22, directed to a method for manufacturing a separator for a fuel cell, as compared with previous claims considered in the above-identified application, directed to a separator. As the present claims recite a method for manufacturing a separator as previously considered, such method being described in Applicants' specification as discussed previously, it is respectfully submitted that method claims should be considered on the merits in the above-identified application, upon further examination in view of the filing of the aforementioned RCE Transmittal.

Applicants respectfully submit that all of the claims presented for consideration by the Examiner patentably distinguish over the teachings of the references applied by the Examiner in rejecting claims in the Office Action mailed November 25, 2008, that is, the teachings of U.S. Patent No. 4,197,178 to Pellegri, et al., and Japanese Patent Document No. 2000-100453 (designated by the Examiner as Tashiro, et al.), under the provisions of 35 USC 102 and 35 USC 103.

With respect to the subject matter of claims 8, 10-12 and 23, it is respectfully submitted that the teachings of the references as applied by the Examiner would have neither disclosed nor would have suggested such a separator as in the present claims, wherein the separator has the property or characteristic that after soaking the

separator at 80°C for 100 hours in 30 times the volume of the molded body of water, total concentration of sodium, potassium, iron, nickel and magnesium released into the soaking water is 20 ppm or less, and concentration of sulfur released into the soaking water is 30 ppm or less. Note claim 8.

It is emphasized that this recitation as to amount of the recited elements released into the soaking water is a property or characteristic of the separator. It is respectfully submitted that such property or characteristic must be considered in determining patentability of the separator, as a whole.

Furthermore, as described in more detail infra, unexpectedly better results are achieved where the separator has the characteristic or property that concentration of sulfur released into the soaking water is 30 ppm or less. The evidence in Applicants' specification, discussed infra, shows such unexpectedly better results. Particularly in view thereof, it is respectfully submitted that the presently claimed subject matter patentably distinguishes over the teachings of the applied references, i.e., Pellegri, et al. and Tashiro, et al.

In addition, it is respectfully submitted that the teachings of the applied references would have neither disclosed nor would have suggested such separator as in the present claims, having features as discussed previously in connection with claim 8, and having additional features as in the claims dependent thereon, including wherein the graphite is expanded graphite (note claim 10); and/or wherein the graphite is a pulverized powder of an expanded graphite sheet (see claim 11); and/or wherein the resin is a thermosetting resin (see claim 12).

Moreover, it is respectfully submitted that these references would have neither disclosed nor would have suggested a fuel cell including the separator according to claim 8. Note claim 23.

Furthermore, the applied references would have neither disclosed nor would have suggested such a method for manufacturing a separator for a fuel cell as in the present claims, the separator including, inter alia, a flat portion, and wherein after pulverizing expanded graphite sheets to yield an expanded graphite powder and mixing the expanded graphite powder with a resin to yield a mixed powder, the mixed powder is subjected to compression molding to yield a sheet for molding, and the sheet for molding is placed on a mold plate, with at least one additional sheet for molding fitted in shape to the flat portion being superposed thereon, with the sheet and at least one additional sheet being subjected to compression molding. See claim 22.

Moreover, it is respectfully submitted that the teachings of these applied references would have neither disclosed nor would have suggested such method as in the present claims, having features as discussed previously in connection with claim 22, and, additionally, wherein the flat portion of the separator has a bending strain at break as in claims 1, 16 and 17, and/or a compressive modulus as in claims 2, 18 and 19, and/or a Shore hardness as in claims 3, 5, 6, 20 and 21.

The invention as presently being claimed in the above-identified application is directed to a separator for a fuel cell, particularly suitable for a polymer electrolyte fuel cell, to a fuel cell using such separator, and to a process for manufacturing such separator.

As described on page 5 of Applicants' specification, a graphite powder/resin molded material as disclosed in International Publication No. WO 97/02612 is made by means of a thermocompression molding method, an injection molding method and the like, from a source material composed of a mixture of carbon powder, graphite powder, a thermosetting resin, a thermoplastic resin and the like.

However, and as described in the paragraph bridging pages 5 and 6 of Applicants' specification, a separator obtained from a graphite powder/resin molded material as previously proposed has a structure in which graphite powder is bonded with the resin, so that water tends to penetrate into the voids between the graphite powder particles and the resin during operation, and the surface of the separator tends to be increased. In addition, disadvantageously components, including metal impurities, elute from the separator; and a fuel cell that uses such separator tends to be deteriorated in cell properties when used over a period of time, and hence there has been a problem involving reliability and durability.

In addition, problems arise when the separators are assembled in a stack, the separators each having a large thickness variation. Such variation causes large local distortions, and tends to increase the possibility of fracture.

Against this background, Applicants provide separators which can be used over a long period of time with good reliability, and which avoid breaking of the separators; and a method of forming such separators wherein the separators can be formed simply and efficiently, and with precision.

According to one feature of the present invention, Applicants have found that where such separator releases at most a specific amount of various elements, including sulfur, under specified conditions, degradation in performance can be avoided when the separator is operated over a long period of time. Note, in particular, the paragraph bridging pages 13 and 14 of Applicants' specification. Note, especially, Example 5 and Comparative Example 5, on pages 45-49 and on pages 51 and 52, of Applicants' specification, with results shown in Table 2 on page 55 of Applicants' specification. Note also the discussion concerning results shown in this Table 2, in the first two paragraphs on page 56 of Applicants'

specification. That is, on page 56, it is stated that it is clear that the separators for fuel cell of Examples 5-7 were small in the amounts of the metal impurities and sulfur released into the soaking water, and maintained high output even for the operation for 100 hours; while, in contrast, the separator for fuel cell of Comparative Example 5 was large in the amounts of metal impurities and sulfur released into the soaking water, which made the soaking water high in conductivity and caused a drawback that short circuiting occurred in 60 hours. It is respectfully submitted that the experimental data in Applicants' specification must be considered in determining patentability of the presently claimed invention, e.g., as in claims 8, f10-12 and 23. See In re DeBlauwe, 222 USPQ 191 (CAFC 1984). Properly considered, it is respectfully submitted that this evidence shows unexpectedly better results achieved when the separator has a release of specified elements, particularly of sulfur, as in the present claims, establishing unobviousness of the presently claimed separator.

Furthermore, the present method comprises a simple and effective method for forming the separator, providing advantages of forming the appropriate separator accurately and efficiently.

According to another aspect of the present invention, Applicants have found that the bending strain at the flat portion at break, rather than bending strength, is an important parameter. As described in the paragraph bridging pages 9 and 10 of Applicants' specification, when the separators are assembled in a stack, the separators are strongly compressed, so that to prevent breaking of the separators in this case, the bending strain at the flat portion at break is important. Additionally, the bending strain at the flat portion at break becomes important for improving adhesivity of the separators and the performance as a fuel cell when a solid polymer film or a carbon paper sheet is sandwiched in each of the separators.

In addition, Applicants have further found that even if the bending strain at the flat portion at break is less than 0.5%, the objective of the present invention can be achieved when the compressive modulus and/or Shore hardness at the flat portion are within ranges as set forth in the present claims. Note the paragraph bridging pages 10 and 11 of Applicants' specification. See also the sole full paragraph on page 11 of Applicants' specification.

It is emphasized that the recited total concentration of sodium, potassium, iron, nickel and magnesium released into the soaking water, and concentration of sulfur released into the soaking water, are those determined after soaking the separator with water under prescribed conditions. These constitute a property of the separator, the property being measured under specific procedures. As will be shown in the following, it is respectfully submitted that the applied references, including Tashiro, et al., would have neither disclosed nor would have suggested controlling the specified properties at the flat portion of the separator for fuel cell to fall within the specific range, or amounts of specific impurities that are released by the separator, as in the present claims, or advantages thereof as discussed previously.

Pellegri, et al. discloses a bipolar separator for electrochemical cells, comprised of a molded aggregate of an electrically conductive powdered material and a powdered thermosetting resin in a weight ratio of 1:1 to 9:1, and having a resistivity coefficient, in the direction perpendicular to the major surfaces of the separator, of less than 0.3 Ωcm; and having the entire surface exposed to the anolyte, except the area of electrical contact with the anode, coated with a layer of a chemically resistant and electrically nonconductive thermosetting resin. See column 2, lines 50-59. Note also column 2, line 65, to column 3, line 6. This patent further discloses that the bipolar separator is made by pressure molding,

conveniently providing for generating the recessed surfaces, projections for the electrical contacts, the grooves and the holes for the circulation of the reagents and the recovery of the products of reaction, and the holes for the passage of assembly tie-rods in a single operation of manufacture. Note column 3, lines 7-14. See also column 3, lines 42-65; and column 4, lines 44-47.

It is respectfully submitted that Pellegri, et al. would have neither taught nor would have suggested such separator as in the present claims, including the characteristic thereof of amount of elements, including sulfur, released into the soaking water, and advantages thereof; and would have neither taught nor would have suggested such method as in the present claims, including forming the sheet for molding by subjecting the specified mixed powder to compression molding, and placing such sheet for molding on a mold plate and superposing at least one additional sheet for molding fitted in shape to the flat portion, with the sheet for molding and at least one additional sheet being subjected to compression molding; and would have neither disclosed nor would have suggested the other features of the present invention, including properties such as bending strain, compressive modulus and Shore hardness of the flat portion of the separator as in various of the present claims, and advantages thereof.

Tashiro, et al. discloses expansive graphite grains having less residual sulfuric acid group (sulfuric acid ions). This patent document discloses that the concentration of sulfuric acid ions in the expansive graphite grains is set to 500 ppm or below; and for the manufacturing method, the expansive graphite powder is compressed, molded and pulverized into expansive graphite grains, and the expansive graphite grains are washed with water and dried, or the expansive graphite powder is compressed and molded, then it is heat treated at 350°C or

above, and cooled and pulverized, or the expansive graphite powder is compressed, molded and pulverized into expansive graphite grains, then the graphite grains are heat-treated at 350°C or more.

It is emphasized that in Tashiro, et al., the concentration of the expansive graphite grains is limited to 500 ppm or below. It is respectfully submitted that this reference, either alone or in combination with the teachings of Pellegri, et al., would have neither disclosed nor would have suggested such separator as in the present claims, wherein the separator (as contrasted to the expansive graphite grains in Tashiro, et al.) has a concentration of sulfur released into the soaking water under specified conditions, of 30 ppm or less, and advantages achieved thereby.

The Examiner acknowledges that Pellegri, et al. fails to specifically state the specified properties (bending strain at break, compressive modulus and Shore hardness) of the separator, but that "one of ordinary skill in the art would understand that these properties are inherent to the composition and method of making the separator". Initially, and as can be seen in the present method claims, the Examiner has not established that the method of Pellegri, et al. is the same as the present method for manufacturing a separator. Accordingly, the Examiner's conclusion of inherency is clearly improper, in that the Examiner has not shown that the method of making the separator is the same.

Furthermore, the Examiner has not established that these properties are inherent, merely alleging that these properties are inherent "to the composition and method of making the separator". Such conclusion, without any evidence in support thereof, is clearly improper. See In re McKellin, 188 USPQ 428 (CCPA 1976).

In the paragraph bridging pages 4 and 5 of the Office Action mailed November 25, 2008, the Examiner notes that Tashiro, et al. discloses a separator

wherein the expanded graphite can be washed to remove impurities such as sulfate ions "in order to create a separator". As recognized by the Examiner, Tashiro, et al. discloses a concentration of sulfuric acid ions in the expansive graphite grains. It is respectfully submitted that such disclosure in Tashiro, et al. would have neither taught nor would have suggested the presently claimed separator as in, for example, claim 8, wherein concentration of sulfur released from the separator is set forth.

To emphasize, it is again noted that the evidence in Applicants' specification shows unexpectedly better results achieved by the present invention, wherein the separator has a release of sulfur, under specified conditions, as in the present claims. It is respectfully submitted that particularly in view of these unexpectedly better results, Applicants have established patentability of the presently claimed separator, over the teachings of the applied references including Tashiro, et al.

The contention by the Examiner in the last full paragraph on page 9 of the Office Action mailed November 25, 2008, that the recitation of soaking the separator in a specified amount of water for a specified amount of time at a specified temperature "is a product-by-limitations of claim 8 and is therefore not given patentable weight since the courts have held that patentability is based on a product itself, even if the prior art product is made by a different process", is noted. Apparently, the Examiner is characterizing the recitation of soaking as a "product-by-process" recitation in claim 8. This characterization by the Examiner is clearly incorrect. As stated previously, Applicants define a characteristic or property of the separator, that is, that the separator has a concentration of sulfur released into soaking water under specified conditions, which is 30 ppm or less. Such characteristic or property of the separator forms part of the definition of the separator as a whole, and must be considered in determining patentability. Such characteristic

or property is not a definition of formation of the separator, as contended by the Examiner, and in view of this misinterpretation of the claims it is respectfully submitted that the Examiner's conclusion as to obviousness, while ignoring what she characterizes to be a product-by-process limitation, is clearly improper.

In view of the foregoing comments and amendments, and in light of the concurrently filed RCE Transmittal, entry of the present amendments, and reconsideration and allowance of all claims then pending in the above-identified application, are respectfully requested.

To the extent necessary, Applicants hereby petition for an extension of time under 37 CFR 1.136. Kindly charge any shortage of fees due in connection with the filing of this paper, including any extension of time fees, to the Deposit Account of Antonelli, Terry, Stout & Kraus, LLP, Account No. 01-2135 (case 500.43947X00), and please credit any overpayments to such Deposit Account.

Respectfully submitted,

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